Section 13 OTHER ROCKFISH

by
Rebecca F. Reuter and Paul D. Spencer

CHANGES FROM LAST YEAR'S ASSESSMENT

Relative to last year's final BS/AI SAFE Report, the following substantive changes have been made in the current draft of the Other Rockfish chapter:

Changes in the Input Data

(1) Catch distribution maps from the fishery and survey were updated for light dusky rockfish

(2) The 2001 landings have been revised and the 2002 landings through September 21, 2002 have been included in the assessment.

(3) Length frequency graphs from survey and fishery data have been updated for light dusky rockfish and shortspine thornyhead.

(4) New biomass estimates for this group were available for the 2003 assessment. The EBS biomass estimate will include those from the 2002 Bering Sea Slope survey. Therefore, the recommended ABC's and OFL's for 2003 are as follows: :

	Eastern Bering Sea		Aleutian Islands	
Other Rockfish	2002	2003	2002	2003
ABC	361 t	960 t	676 t	634 t
OFL	482 t	1,280 t	901 t	846 t

Changes in Assessment Results

(5) Author's recommendation on splitting out Light dusky rockfish.

	Eastern Bering Sea	Aleutian Islands
Other Rockfish	2003	2003
(no Lt. Dusky)		
ABC	954 t	595 t
OFL	1,272 t	793 t

	BSAI*	EBS	AI
Light Dusky (Tier 5)	2003	2003	2003
ABC	58 t	7 t	51 t
OFL	77 t	9 t	67 t

*author recommended

SSC comments specific to Other Rockfish complex

During the 2001 December council meeting the SSC made the following comments that are relative to the Other Rockfish complex: "*SSC concurs with the suggestions"* of moving sharpchin rockfish from the Other red rockfish complex into the Other rockfish complex. The SSC made a general comment: *"Some of the rockfish complexes are comprised of many species that are relatively rare in the study areas. As a measure of the degree of scarcity of these species it might be useful to show which of these scarce species are more abundant in other geographic ranges."*

Response to SSC comments:

Sharpchin rockfish have been added to the Other rockfish complex, and their biomass was included in the estimate of exploitable biomass for calculation of the ABC/OFL. They have also been included in Table 13.1 that describes those rockfish species in the complex.

The only species in the other rockfish complex that is most abundant is shortspine thornyheads, as they comprise about 95% of the Other rockfish biomass. The author would consider the remaining of the species could be defined as relatively rare in this area. Of these species it is known that the center of abundance for Light dusky rockfish is in the Gulf of Alaska, mainly the central GOA near Kodiak (2002 exploitable biomass estimate ~56,000 t for GOA, Clausen and Heifetz 2001). Information for the other species will be presented at a later date.

Other information added to Assessment

Table 13.9 was added per the "Ecosystem considerations in individual groundfish stock assessments" memo of June 10th, 2002 from Pat Livingston.

OTHER ROCKFISH

by
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INTRODUCTION

The Other rockfish complex includes all species of *Sebastes* and *Sebastolobus* spp. other than Pacific ocean perch *(Sebastes alutus)* and those species in the Other red rockfish complex (northern rockfish, *S. polyspinis*; rougheye rockfish, *S. aleutianus*; and shortraker rockfish, *S. borealis*;). This complex is one of the rockfish management groups in the Bering Sea and Aleutian Island (BSAI) regions. Seven out of twenty-nine species of "other rockfish" have been confirmed or tentatively identified in catches from the eastern Bering Sea and Aleutian Islands region (Reuter and Spencer 2001). Table 13.1 lists the 29 species in the other rockfish complex. These species have been observed at least once in the BSAI surveys and/or have occurred in at least 1% of the hauls where an species from the other rockfish category has been caught. The two most abundant species for this complex are light dusky rockfish (*Sebastes ciliatus sp cf*) and shortspine thornyheads (*Sebastolobus alascancus*)

The distribution of these other rockfish is not well documented in the BSAI regions. Light dusky rockfish are occasionally observed in AFSC research surveys throughout the Aleutian Islands. When observed light dusky rockfish are typically captured between 125 -200 m (Reuter and Spencer 2001). Catches of shortspine thornyheads, in the Aleutian Island (AI) region are observed around the islands along the bathymetric contours between 200 m and 500 m (Reuter and Spencer 2001). In the Eastern Bering Sea (EBS) light dusky rockfish are rarely encountered in the catches of either the survey or the fishery. Whereas, the shortspine thornyhead distribution is similar to that found in the AI with most encounters occurring in survey and fishery tows deeper than 200 m (Reuter and Spencer 2001).

Recently, in the Aleutian Islands, bycatch of light dusky rockfish is highest near Seguam pass and Petrel Bank (Figure 13.1). This contrasts the locations where the AFSC AI survey catch light dusky rockfish (Figure 13.2). In the 2000 and 2002 AI surveys, light dusky catch was highest at the western tip of Amchitka Island. (Figure 13.2).

Locations of light dusky rockfish bycatch in the Eastern Bering Sea fisheries are peppered along the slope, and in the region just north of Unalaska Island and Akutan Island (Figure 13.3). In the 2002 AI survey, locations of light dusky rockfish catch were similar to fishery bycatch distributions for areas near Unalaska Island and Akutan Island (Figure 13.4).

DATA

The data used in this assessment include estimates of total catch, bottom trawl survey biomass estimates, and length frequency data from the fishery and bottom trawl surveys.

Catch History

Since 1977, rockfish have been identified to the species level in fishery catches by U.S. observers, this has provided a means of estimating annual harvests of individual species. Of the species in the "other rockfish" group, there are two *predominant* species in both the survey and fishery catches, light dusky rockfish (*S. ciliatus*) and shortspine thornyheads (*Sebastolobus alascanus*).

Historical catches of other rockfish since implementation of the MFCMA are shown in Table 13.2. Catches prior to 1990 are assumed to include discards; whereas, catches during the period 1990-2000

explicitly account for discards based on NMFS Regional Office and observer information. The peak catch of other rockfish in the EBS occurred in 1978 with a removal of 2,600 t. In the Aleutian region, peak catch occurred in 1979 with a harvest of 4,500 t. Note that in 2001 removals of other rockfish were revised using the current species complex (Reuter and Spencer 2001).

In recent years in both the Aleutian Islands (AI) and eastern Bering Sea (EBS), the bulk of the other rockfish catch was comprised of light dusky rockfish and shortspine thornyheads (Table 13.3). These catches were extrapolated from samples taken by fishery observers (Note: this is not the total harvest for this group). Figure 13.5a, illustrates that in the AI light dusky rockfish account for 50% (1997) to 80% (2001) of the other rockfish catch. Whereas in the EBS, shortspine thornyhead account for 60% (1998) to 85% (2002) of the other rockfish catch (Figure 13.5b).

Other rockfish catch increased since 1998 in both the Aleutian Islands and Eastern Bering Sea (Figure 13.6). In the AI the light dusky rockfish catch has increased from ~50 t in 1997 to ~ 200 t in 2001 (Figure 13.6a). In the EBS the shortspine thornyhead catch has been relatively stable at ~80-100 t since 1997 (Figure 13.6b).

The target fisheries that catch these two species are described in Table 13.4. These target fisheries are defined by which species or species group makes up at least 75% of the catch. During 2000 and 2001 in the AI, 65% to 80% of the total light dusky rockfish catch was caught during the Atka mackerel trawl fishery and 33% to 40% of the total shortspine thornyhead catch was caught using longline gear in hauls whose target we describe as "other fish"(2000) (grenadiers and/or skates) and the sablefish (*Anoplopoma fimbria*) longline fishery (2001). During the same years in the EBS, minor (<10t) quantities of light dusky rockfish bycatch was found in hauls designated as the pollock (*Theragra chalcogramma*) pelagic trawl fishery, the Pacific cod (*Gadus macrocephalus*) longline fishery and the northern rockfish bottom trawl fishery. Shortspine thornyhead bycatch was found mainly in the Arrowtooth/Kamchatka flounder bottom trawl fishery and the Greenland turbot longline fishery.

Other rockfish retained and discarded catch are shown in Table 13.5. In the Aleutian Islands on average 48 % of those species in the other rockfish category were discarded. In the Eastern Bering Sea on average 37 % of those species in the other rockfish category were discarded. The difference in discard rates in these areas may be due to the difference in species composition. Shortspine thornyheads are a higher priced species and are caught mainly by fixed-gear (i.e., higher quality flesh) than light dusky rockfish thus may be retained at higher rates (Hiatt, Felthoven and Terry 2002).

Fishery Independent Surveys

Several bottom trawl surveys provide biomass estimates of exploitable biomass for the EBS and AI regions. The 1979-86 cooperative U.S.-Japan trawl surveys in the EBS were conducted both on the continental shelf and slope. A majority of catches of other rockfish were taken by Japanese research trawlers working the slope regions at depths exceeding 200 m. In 1991 trawl surveys were conducted in both the EBS and Aleutian regions. These surveys, however, were conducted entirely by domestic trawlers and did not include participation by the deeper-water Japanese research trawlers. The most recent trawl surveys occurred in 1997, 2000 and 2002 in the Aleutian Islands region. The first official EBS slope survey was conducted in 2002 thus biomass estimates from this survey will be used because it provides a better estimate of shortspine thornyhead biomass for this region. It should be noted that only 3 individual light dusky rockfish were caught during the 2002 Bering Sea slope survey. This will be the first biomass of this new time series.

Survey Biomass Estimates

Biomass estimates for other rockfish were produced from cooperative U.S.-Japan trawl surveys from 1979-1985 on the eastern Bering Sea slope, and from 1980-1986 in the Aleutian Islands. U.S domestic trawl surveys were conducted in 1988, 1991 and 2002 on the eastern Bering Sea slope, and in 1991,1994, 1997, 2000, and 2002 in the Aleutian Islands (Table 13.5). The biomass for the EBS group of other rockfish is comprised of 2 components--the EBS shelf-slope component and the Aleutian component of Bering Sea area 1 (Table 13.6).

In the AI region, the large change in biomass estimates from the 1979-1986 to the 1991-2000 surveys may be due to the differences in vessel type, gear type and survey methodology (Table 13.6). The spatial coverage and survey methods used during 1979 -1986 and 1991 - 2000 were consistent within a time period. Since 1994, the AI groundfish trawl biomass estimates for light dusky rockfish have been stable. The AI groundfish trawl biomass estimates for light dusky rockfish decreased from 1,232 t in 2000 to 445 t in 2002. Since 1994, the AI groundfish trawl biomass estimates for shortspine thornyhead have been increasing. The AI groundfish trawl biomass estimates for shortspine thornyhead increased from 9,813 t in 2000 to 14,243 t in 2002.

In the AI the exploitable biomass estimate is the average of the 3 most recent surveys, in this year's stock assessment those are the 1997, 2000 and 2002 AI surveys. The EBS is divided into two areas when determining the biomass of the other rockfish category. The two areas are; the shelf/slope area, which, has a new biomass estimate for 2002 and the area that is labeled the AI portion of the southern EBS, whose biomass estimate is attained on those years when the AI survey occurs (Table 13.6). For the latter portion of the EBS the exploitable biomass estimate that is used in this assessment is the average of the 3 most recent AI surveys (1997, 2000 and 2002) for the southern EBS plus the average of the most recent estimate from the EBS slope survey (because the 2002 estimate is the beginning of a new survey time series, it was not averaged with the 1991 slope survey) .

Recent survey data indicate that shortspine thornyhead, light dusky rockfish and harlequin rockfish make up the bulk of the survey catches of other rockfish. The most recent survey estimates indicate that ~ 90% of the other rockfish biomass is comprised of shortspine thornyhead (Table 13.7).

LENGTH FREQUENCY

Length frequency graphs show that the size composition of the available light dusky rockfish population to both the fishery and the survey is fairly consistent throughout the years. Although infrequently encountered during the AI surveys, the length frequency graphs of light dusky rockfish consistently show that mainly fishover 30 cm are captured with this gear type (Figure 13.7). Prior to 2002 there is little information regarding the length frequency of light dusky rockfish therefore, the length frequency graphs that are shown in Figure 13.10a may not represent the exploited population. In 2002, observers measured light dusky when they were encountered. The length distribution of the 2002 collections shows the mean length of fish caught in the fishery (42 cm) was larger than fish caught in the survey (39 cm).

Shortspine thornyhead length frequency from the AI trawl survey show that the majority of the specimens sampled were between 20 and 50 cm (Figure 13.8). Similar length frequency graphs for shortspine thornyhead are given from the EBS slope surveys (Figure 13.9).

The exploited portion of the population of shortspine thornyhead in the BSAI region are adequately represented and Figure 13.10b shows that individuals between 30 cm and 60 cm are consistently caught by the fishery. The available data do not span a long enough time period to detect any strong year-classes for long-lived species such as rockfish.

Length at Age

Currently, there are no length at age data for either light dusky rockfish or shortspine thornyheads in the BSAI. For light dusky rockfish age data are available from the Gulf of Alaska and may be used to get approximations in the BSAI (Clausen and Heifetz 2001).

Weight at Length

The best length-weight information for light dusky rockfish comes from the 2002 biennial AI survey, no samples were recorded for the 2000 survey. For combined sexes (n = 84), using the formula $W=aL^b$, where W is weight in grams and L is fork length in mm, $a = 3 \times 10^{-6}$ and b = 3.28 (Reuter, unpublished data).

Author's recommendation to split out Light Dusky rockfish from Other rockfish ABC

An effort was made to look for disproportionate exploitation of any one of the species in the Other rockfish category. This effort was motivated by the fact that while 95% of the other rockfish biomass is made up of the shortspine thornyhead biomass, light dusky rockfish are the predominant catch in the Aleutian Islands (Table 13.3). This finding indicated that light dusky rockfish were being disproportionately exploited. Table 13.8 shows that, since 1997, harvest rates (catch/biomass) for light dusky rockfish ranged from 0.19 to 0.56 in the Aleutian Islands and 0.21 to 0.80 in the Eastern Bering Sea. The Eastern Bering Sea harvest rates may be elevated due to the inadequacy of the AFSC survey gear to sample areas where they are caught by the gear used by the fishery. Based on this information we recommend that light dusky rockfish are split out from the Other Rockfish ABC and OFL determination.

Author's recommendation for combining the BS and AI stocks

The other rockfish complex is currently managed as two separate stocks in the EBS and AI regions. The light dusky rockfish survey and fishery bycatch distributions show a continuous spatial distribution along the AI and up the EBS slope, thus may be a single stock in the BSAI region. This is plausible because the abundance of light dusky rockfish in the EBS decreases substantially north of the Aleutian archipelago. Furthermore, stock mixture may occur with larval flow from the Aleutian archipelago, along the Aleutian North Slope Current towards the Bering sea slope (Hinkley 1999). Therefore, it is recommended that the biomass estimate for light dusky rockfish be combined for the BSAI.

REFERENCE FISHING MORTALITY RATES AND YIELDS

Information is lacking to calculate reference fishing mortality rates and yields that directly conserve spawning stock biomass. Harvest recommendations for EBS and AI other rockfish are based on Tier 5 methods. The value of M (0.07), represents an approximation based on knowledge of rockfish life histories from other areas. This value is based on the estimate for shortspine thornyheads (Ianelli and Ito 1994) since this species evidently comprises well over 90% of the other rockfish biomass (as calculated by survey data).

Under tier 5, a fishing mortality rate equal to 75% of the natural mortality rate is the maximum allowable F (ABC) value. Therefore, the estimate of ABC for the eastern Bering Sea region is 960 t (0.75 x 0.07 x 18,290 t) and 634 t (0.75 x 0.07 x 12,087 t) for the Aleutian Islands region.

Based on the overfishing definition, the overfishing level (OFL) is computed assuming $F_{OFL} = M$. Thus, the overfishing level for the eastern Bering Sea region is 1280 t and 846 t for the Aleutian Islands region.

Alternative ABC with light dusky rockfish managed separately

Similar to the Other rockfish category, information is lacking to calculate reference fishing mortality rates for light dusky rockfish. Clausen and Heifetz (2001) provide an estimate of the natural mortality rate for light dusky rockfish of 0.09 in the GOA (Clausen and Heifetz 2001). Based on this estimate, the tier 5 estimate of ABC for light dusky rockfish in the BSAI is 58 t (0.75 x 0.09 x 856 t) and the estimate for OFL is 77 t ($F_{OFL} = M$). Light dusky rockfish have a Tier 4 status in the Gulf of Alaska (GOA) and may be considered for this status in the BSAI after studying the similarities and differences of light dusky in these two regions (Clausen and Heifetz 2001).

Other rockfish ABC (minus Light dusky rockfish):

Under tier 5, a fishing mortality rate equal to 75% of the natural mortality rate is the maximum allowable F (ABC) value. Therefore, the estimate of ABC for the eastern Bering Sea region is 954 t (0.75 x 0.07 x 18,168) and 595 t (0.75 x 0.07 x 11,337) for the Aleutian Islands region.

Based on the overfishing definition, the overfishing level (OFL) is computed assuming $F_{OFL} = M$. Thus, the overfishing level for the eastern Bering Sea region is 1272 t and 793 t for the Aleutian Islands region.

SUMMARY

A summary of the estimates of current exploitable biomass and ABC for the other rockfish group in the EBS and Aleutian Islands region is provided in the following table:

Other Rockfish:

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
EBS	0.07	18,290	960	1,280
AI	0.07	12,087	634	846

A summary of the estimates of current exploitable biomass and ABC for Other rockfish without light dusky biomass in the EBS and Aleutian Islands region and light dusky in the BSAI is provided in the following table :

Other Rockfish (minus Light dusky rockfish):

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
EBS	0.07	18,168	954	1,272
AI	0.07	11,337	595	793

Light Dusky rockfish (Tier 5):

Region	M	Exploitable biomass (t)	ABC (t)	OFL (t)
Author recommended:				
BSAI	0.09	856	58	77
or				
EBS	0.09	105	7	9
AI	0.09	751	51	67

REFERENCES

Clausen D. and J. Heifetz. 2001. Pelagic Shelf Rockfish *In:* Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska as projected for 2002. Nov. 2001. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Hiatt, T., R. Felthoven and J. Terry. 2002. Economic status of the groundfish fisheries off Alaska, 2001. *In:* Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska and the Bering Sea/Aleutian Islands. Unpublished. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Hinkley, S. 1999. Biophysical mechanisms underlying the recruitment process in walleye pollock. Univ. WA PhD. dissertation.

Ianelli, J.N., and S. Gaichas. 1999. Thornyheads. *In:* Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska as projected for 2000. Nov. 1999. North Pacific Fishery Management Council, P.O Box 103136, Anchorage, AK 99510.

Ianelli, J.N., and D.H. Ito. 1994. Status of the thornyhead (*Sebastolobus sp*.) resource in 1994. *In:* Stock assessment and fishery evaluation report of the Gulf of Alaska as projected for 1995 (November 1994), 26 pp. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, AK 99510.

Reuter, R.F., and P.D. Spencer 2001. Other Rockfish *In*: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea and Aleutian Islands as projected for 2002. Nov. 2001. North Pacific Fishery Management Council, P.O., Box 103136, Anchorage, AK 99510.

Table 13.1. List of species in the Other rockfish complex.

Dark dusky rockfish	*cf. ciliatus*
Light dusky rockfish	*Sebastes ciliatus*
Harlequin rockfish	*Sebastes variegatus*
Red banded rockfish	*Sebastes babcocki*
Redstripe rockfish	*Sebastes proriger*
Yelloweye rockfish	*Sebastes rubberimus*
Aurora rockfish	*Sebastes aurora*
Black rockfish	*Sebastes melanops*
Blackgill rockfish	*Sebastes melanostomus*
Blue rockfish	*Sebastes mystinus*
Boccaccio	*Sebastes paucispinis*
Canary rockfish	*Sebastes pinniger*
Chillipepper rockfish	*Sebastes goodei*
Copper rockfish	*Sebastes caurinus*
Dark blotched rockfish	*Sebastes crameri*
Greenstriped rockfish	*Sebastes elongatus*
Pygmy rockfish	*Sebastes wilsoni*
Rosethorn rockfish	*Sebastes helvomaculatus*
Silvergray rockfish	*Sebastes brevispinis*
Splitnose rockfish	*Sebastes diploproa*
Stripetail rockfish	*Sebastes saxicola*
Tiger rockfish	*Sebastes nigrocinctus*
Vermillion rockfish	*Sebastes miniatus*
Widow rockfish	*Sebastes entomelas*
Yellowmouth rockfish	*Sebastes reedi*
Yellowtail rockfish	*Sebastes flavidus*
Sharpchin rockfish	*Sebastes zacentrus*
Shortspine Thornyhead	*Sebastolobus alascanus*
Longspine thornyhead	*Sebastolobus altivelis*

Table 13.2.--Summary of catches (t) of other rockfish in the eastern Bering Sea and Aleutian Islands regions. Source: NMFS/AK regional website.

	Eastern Bering Sea				Aleutian Islands			
		Domestic				Domestic		
Year	Foreign	JVP	DAP	Total	Foreign	JVP	DAP	Total
1977**	112	--	--	112	700	--	--	700
1978**	941	--	--	941	212	--	--	212
1979**	759	--	--	759	1,039	--	--	1,039
1980	456	3	--	459	420	--	--	420
1981	331	--	25	356	328	--	--	328
1982	262	11	3	276	2,114	--	--	2,114
1983	212	8	--	220	1,041	4	--	1,045
1984	121	8	47	176	42	14	--	56
1985	33	3	56	92	2	14	83	99
1986	4	12	86	102	Tr	15	154	169
1987	3	4	467	474	0	6	141	147
1988	0	8	333	341	0	68	210	278
1989	0	4	188	192	0	0	481	481
1990	0	0	418	418	0	0	858	858
1991	0	0	422	422	0	0	343	343
1992	0	0	600	600	0	0	664	664
1993	0	0	192	192	0	0	496	496
1994	0	0	133	133	0	0	292	292
1995	0	0	288	288	0	0	219	219
1996	0	0	170	170	0	0	282	282
1997	0	0	163	163	0	0	305	305
1998	0	0	188	188	0	0	364	364
1999	0	0	135	135	0	0	631	631
2000	0	0	232	232	0	0	563	563
2001	0	0	295	295	0	0	592	592
2002(1)	0	0	362	362	0	0	487	487

**These biomass estimates were revised (2001) to show the catch of those species currently in the other rockfish category.

(1) Estimated removals through September 21, 2002.

Table 13.3. Observed fishery catch (t) of top species in other rockfish group in the Aleutian Islands and eastern Bering Sea from 1998-2002.
Source: North Pacific Observer Database AFSC Seattle WA.

Aleutian Islands

2002*	E	C	W	Total
Light Dusky	63	26	21	**110**
Shortspine	8	7.5	13.5	**29**
Thorny unid.	1	4	10	**15**
Harlequin	< 1	11	1.5	**13**
Rockfish unid.	4	< 1	1	**6**
Total	**76**	**48.5**	**47**	**173**

2001	E	C	W	Total
Light Dusky	145	63	44	**252**
Shortspine	20	13	8	**41**
Harlequin	3	8	12	**23**
Dark Dusky	1	5	4	**10**
Thorny unid.	8	< 1	< 1	**8**
Total	**182.5**	**93**	**112**	**387.5**

2000	E	C	W	Total
Light Dusky	192	65	6	**263**
Shortspine	46	22	19	**87**
Rockfish unid.	6	26	2	**34**
Harlequin	12	14	2	**28**
Redstripe	<1	<1	8	**8**
Total	**256**	**127**	**37**	**420**

1999	E	C	W	Total
Light Dusky	158	27	7	**191**
Rockfish unid.	105	13	2	**120**
Shortspine	24	21	16	**61**
Redstripe	<1	18	29	**47**
Harlequin	2	6	13	**21**
Thorny unid.	8	9	3	**20**
Dark Dusky	5	9	3	**17**
Total	**302**	**103**	**73**	**477**

1998	E	C	W	Total
Light Dusky	84	20	3	**107**
Shortspine	28	21	6	**55**
Rockfish unid.	6	0	31	**37**
Harlequin	1	11	7	**19**
Small red Rockfish group	0	0	10	**10**
Redstripe	0	8	0	**8**
Total	**119**	**60**	**57**	**236**

*Observed catch as of August 20, 2002

Eastern Bering Sea

2002*	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	10	15	**25**
Light Dusky	< 1	3	**3**
Thorny unid.	< 1	1	**1**
Rockfish unid.	< 1	2	**2**
Total	**10**	**21**	**31**

2001	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	7.5	96	**104**
Light Dusky	4	18	**22**
Thorny unid.	3.5	5.5	**9**
Rockfish unid.	2	5	**7**
Total	**15**	**120**	**135**

2000	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	13	71	**84**
Light Dusky	6	11	**17**
Rockfish unid.	10	2	**12**
broad banded thorny.	4	< 1	**4**
dark dusky	2	2	**4**
Total	**35**	**86**	**121**

1999	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	10	28	**38**
Light Dusky	2	16	**18**
Rockfish unid.	3	3	**6**
Small Red Rockfish Group	<1	3	**3**
Thornyhead unid.	1	3	**4**
Total	**16**	**53**	**69**

1998	No. Bering Sea	So. Bering Sea (517-519)	Total
Shortspine thornyhead	19	44	**63**
Light Dusky	14	18	**32**
Rockfish unid.	1	2	**3**
Black rockfish	5	<1	**5**
Thornyhead unid.	1	2	**3**
Total	**40**	**66**	**106**

*Observed catch as of August 20, 2002

Table 13.4. Catch (t) of Light dusky rockfish and Shortspine thornyhead by target fishery and gear type f or 2001, and 2000. *Source: NorPac Database AFSC Seattle WA.*

2001

Aleutian Islands

Light dusky rockfish

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Atka Mackerel	194	-	-	**194**
Pacific Cod	7	< 1	30	**38**
Northern rockfish	11	-	< 1	**11**
Total	**212**	**< 1**	**30**	**243**

Shortspine thornyhead

	Geartype			
Target fishery	**Trawl**	**Pot**	**Longline**	**Total**
Sablefish	-	< 1	9	**9**
Other Fish	-	< 1	9	**9**
POP	9	-	-	**9**
Total	**9**	**< 1**	**18**	**27**

Eastern Bering Sea

Light dusky rockfish

	Gear type				
Target fishery	**Bottom trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Pollock	1	9	-	-	**10**
Northern rockfish	6	-	-	-	**6**
Pacific Cod	< 1	5	-	-	**5**
Total	**7**	**14**	**-**	**-**	**21**

Shortspine thornyhead

	Gear type				
Target fishery	**Bottom Trawl**	**Pelagic trawl**	**Pot**	**Longline**	**Total**
Arrowtooth/ Kamchaka	67	-	-	< 1	**68**
Greenland Turbot	16	-	-	5	**21**
Pollock	<1	5	-	-	**5**
Flathead Sole	4	-	-	-	**4**
Other Fish	1	-	< 1	3	**4**
Total	**88**	**5**	**< 1**	**8**	**102**

*Other fish target made up mainly of grenadiers and/or skates

2000

Aleutian Islands

Light dusky rockfish

Target fishery	Geartype			Total
	Trawl	Pot	Longline	
Atka mackerel	167	0	0	**167**
POP	35	0	0	**35**
P. Cod	11	< 1	19	**30**
Northern	26	0	0	**26**
Total	**239**	**< 1**	**19**	**258**

Shortspine thornyhead

Target fishery	Geartype			Total
	Trawl	Pot	Longline	
Other fish*	0	< 1	34	**34**
Greenland Turbot	0	0	18	**18**
POP	17	0	< 1	**17**
Sablefish	0	< 1	14	**14**
Total	**17**	**< 1**	**66**	**83**

Eastern Bering Sea

Light dusky rockfish

Target fishery	Gear type				Total
	Bottom trawl	Pelagic trawl	Pot	Longline	
Pacific Cod	2	< 1	< 1	4	**6**
Pollock	< 1	4.5	0	0	**4.5**
POP	2.5	0	0	0	**2.5**
Northern	2	0	0	0	**2**
Total	**6.5**	**4.5**	**< 1**	**4**	**15**

Shortspine thornyhead

Target fishery	Gear type				Total
	Bottom Trawl	Pelagic trawl	Pot	Longline	
Arrowtooth/ Kamchatka	29	0	< 1	1.5	**30.5**
Greenland Turbot	13	0	< 1	14	**27**
Other fish*	7	0	< 1	7	**14**
Pollock	< 1	7	0	0	**7**
Shortraker rockfish	2	0	0	0	**2**
Shortspine thorny.	1	0	0	0	**1**
Total	**52**	**7**	**< 1**	**22.5**	**81.5**

*Other fish target made up mainly of grenadiers and/or skates

Table 13.5. Other rockfish retained and discarded catch for the Aleutian Islands and the Eastern Bering Sea 1995-2001. *Source: AFSC Blend database*

Other Rockfish

AI	Retained	Discarded	Total	Percent Discarded
2001	319	272	591	46
2000	340	223	563	40
1999	250	381	631	60
1998	127	237	364	65
1997	153	152	305	50
1996	155	127	282	45
1995	144	75	219	34
EBS				
2001	237	57	294	19
2000	167	65	232	28
1999	78	57	135	42
1998	120	67	187	36
1997	107	56	163	34
1996	97	73	170	43
1995	126	162	288	56

Table 13.6. Estimated biomass (t) of "other rockfish" from the NMFS bottom trawl surveys. Coefficient of variation in parenthesis.

	Eastern Bering Sea (EBS)		
	EBS slope	Aleutians portion of EBS Area 1	Aleutian Region
1979	3,251	--	--
1980	--	1,095	19,078
1981	4,975	--	--
1982	4,381	--	--
1983	--	1,696	15,995
1984	--	--	--
1985	5,127	--	--
1986	--	5,187	20,336
1987	--	--	--
1988	8,759	--	--
1989	--	--	--
1990	--	--	--
1991	4,529	246 (0.49)	6,668 (0.22)
1992	--	--	--
1993	--	--	--
1994	--	1,171 (0.48)	6,449 (0.16)
1995	--	--	--
1996	--	--	--
1997	--	1,683 (0.63)	10,063 (0.17)
1998	--	--	--
1999	--	--	--
2000	--*	1,107 (0.45)	11,170 (0.14)
2001	--	--	--
2002	16,988 (0.11)	1,116 (0.37)	15,029 (0.03)

*Biomass estimates from the 2000 EBS slope survey were not used in stock assessment.

Table 13.7. Biomass estimates (t) of the main species from the other rockfish group caught during the most recent Aleutian Islands surveys;by species, year and management area.
Note: Biomass totals are different than for Other rockfish category.

2002	E	C	W	Total AI	Southern BS	total BSAI
Shortspine thornyheads	543	5,454	8,246	14,243	1,012	**15,255**
Light Dusky	149	261	36	446	97	**543**
Darky Dusky	0	0	318	318	5	**323**
Total				**15,007**	**1,114**	**16,121**

2000	E	C	W	Total AI	Southern BS	total BSAI
Shortspine thornyheads	522	3,815	5,476	9,813	1,051	**10,689**
Light Dusky	468	579	186	1,233	55	**1,288**
Dark Dusky	0	0	99	99	0	**99**
Harlequin	8	15	3	26	0	**26**
Total				**11,171**	**1,116**	**12,102**

1997	E	C	W	Total AI	Southern BS	total BSAI
Shortspine thornyheads	159	2,011	6,726	8,896	1,545	**10,441**
Light Dusky	442	78	54	574	138	**712**
Dark Dusky	32	10	482	524	0	**524**
Harlequin	5	53	10	68	0	**68**
Total				**10,062**	**1,683**	**11,745**

1994	E	C	W	Total AI	Southern BS	total BSAI
Shortspine thornyheads	187	1,554	4,499	6,240	1,071	**7,311**
Light Dusky*	7	51	31	89	97	**186**
Dark Dusky*	0	1	101	102	2	**104**
Harlequin	5	12	1	18	2	**20**
Total				**6,449**	**1,172**	**7,621**

1991	E	C	W	Total AI	Southern BS	total BSAI
Shortspine thornyheads	115	908	5,143	6,166	187	**7,264**
Light Dusky*	123	338	3	339	57	**614**
Dark Dusky*	4	4	9	17	1	**18**
Harlequin	2	14	4	20	0	**20**
Total				**6,542**	**245**	**7,916**

* 1991 and 1994 light and dark dusky biomass determined by proportion (based on 3 more recent survey data) of “dusky” catch

Table 13.8-Harvest rates for Light dusky rockfish and Shortspine thornyheads in the Aleutian Islands and Eastern Bering Sea regions. (*Note: Catch is total catch.*)

Eastern Bering Sea

	Light Dusky rockfish				Shortspine Thornyhead			
	biomass(t)	CV	Catch (t)	Harvest rate	biomass (t)	CV	Catch (t)	Harvest rate
1997	138	0.46	33	0.23	1,545	0.68	112	0.07
1998	138	0.46	53	0.38	1,545	0.68	107	0.07
1999	55	0.35	31	0.56	876	0.48	69	0.08
2000	55	0.35	30	0.54	876	0.48	155	0.18
2001	55	0.35	44	0.80	876	0.48	212	0.24
2002*	122**	0.31	26	0.21	17,944**	0.11	270	0.01

**Includes Bering Sea Slope Survey Biomass estimate

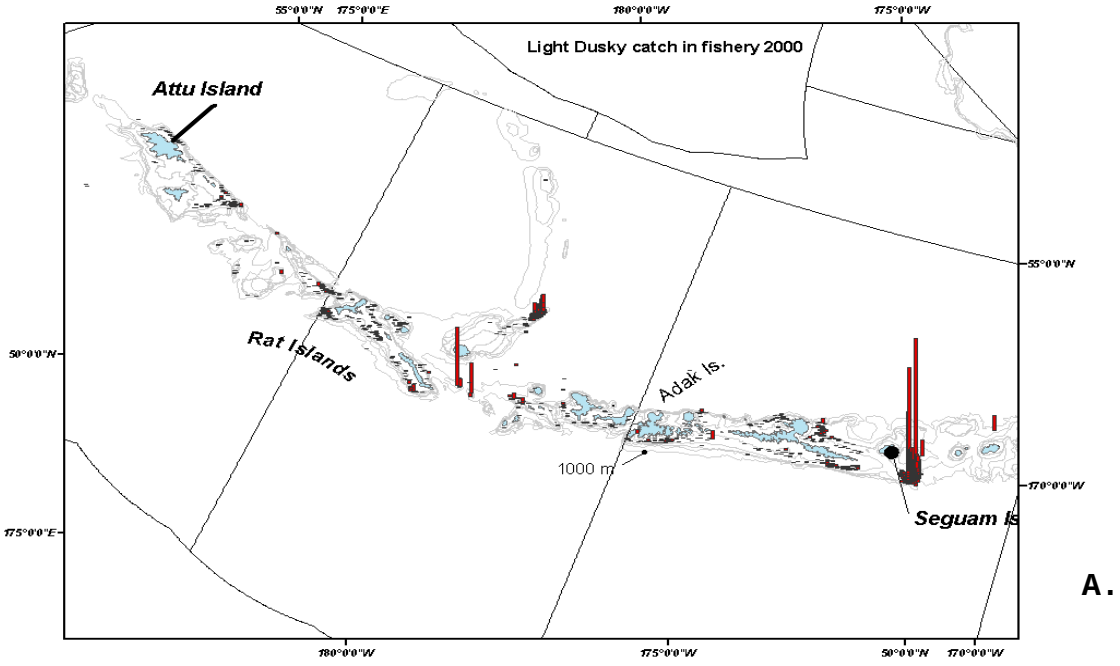
Aleutian Islands

	Light Dusky rockfish				Shortspine Thornyhead			
	biomass (t)	CV	Catch (t)	Harvest rate	biomass (t)	CV	Catch (t)	Harvest rate
1997	574	0.76	137	0.19	8,896	0.18	140	0.01
1998	574	0.76	164	0.23	8,896	0.18	84	0.01
1999	1,232	0.34	246	0.20	9,813	0.15	76	0.01
2000	1,232	0.34	332	0.27	9,813	0.15	113	0.01
2001	1,232	0.34	373	0.30	9,813	0.15	59	0.01
2002*	445	0.32	249	0.56	14,243	0.20	63	0.004

*Catch data as of September 9th 2002

Table 13.9. Analysis of ecosystem considerations for Other Rockfish. Note. None of the species in the Other Rockfish complex are part of a targeted fishery. NA mean data not available and/or not relevant to this complex.

Indicator	*Observation*	*Interpretation*	*Evaluation*
ECOSYSTEM EFFECTS ON STOCK			
Prey availability or abundance trends	summarize the past, present and foreseeable future trends	provide interpretation of how the trend affects the stock	indicate whether the trend is of : no concern possible concern definite concern
Predator population trends	NA	NA	
Changes in habitat quality	NA	NA	
FISHERY EFFECTS ON ECOSYSTEM			
Fishery contribution to bycatch	summarize the past, present and foreseeable future trends	provide interpretation of how the trend affects the ecosystem	indicate whether the trend is of : no concern possible concern definite concern
Prohibited species	NA	NA	
Forage (including herring, Atka mackerel, cod, and pollock)	NA	NA	
HAPC biota (seapens/whips, corals, sponges, anemones)	NA	NA	
Marine mammals and birds	NA	NA	
Sensitive non-target species	NA	NA	
Fishery concentration in space and time	NA	NA	
Fishery effects on amount of large size target fish	NA	NA	
Fishery contribution to discards and offal production	NA	NA	
Fishery effects on age-at-maturity and fecundity	**NA**	**NA**	



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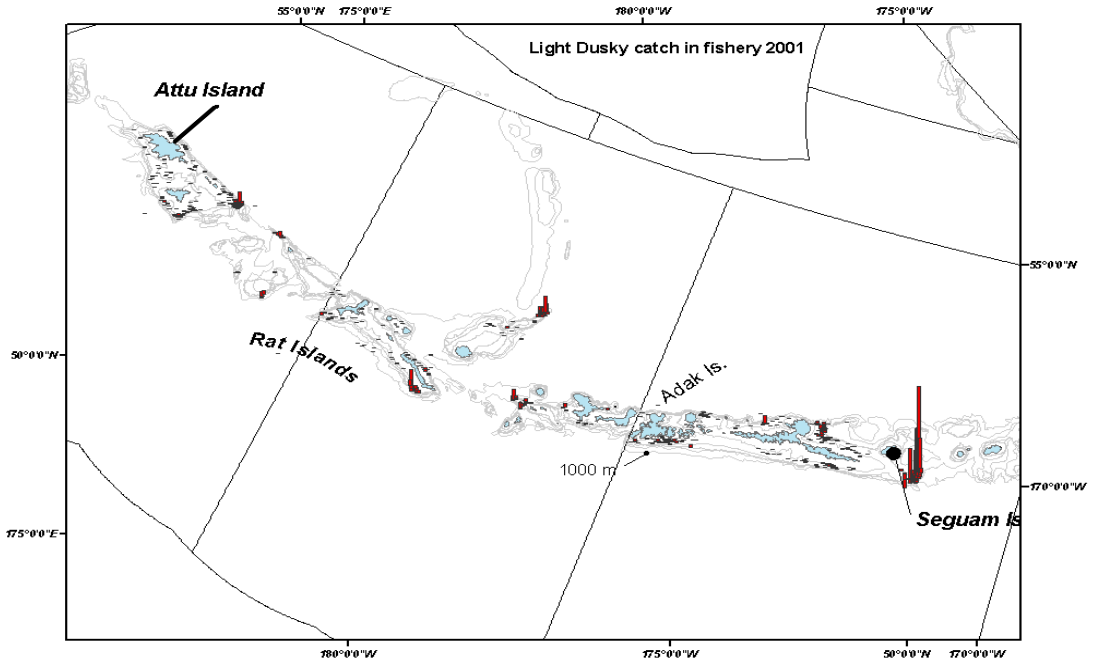


B.

Figure 13.1. Light Dusky catch locations in the Aleutian Islands from fishery observer data A. 2000 and B. 2001, (datasource: AFSC NORPAC database). *Note: Bars from different years are proportional.*

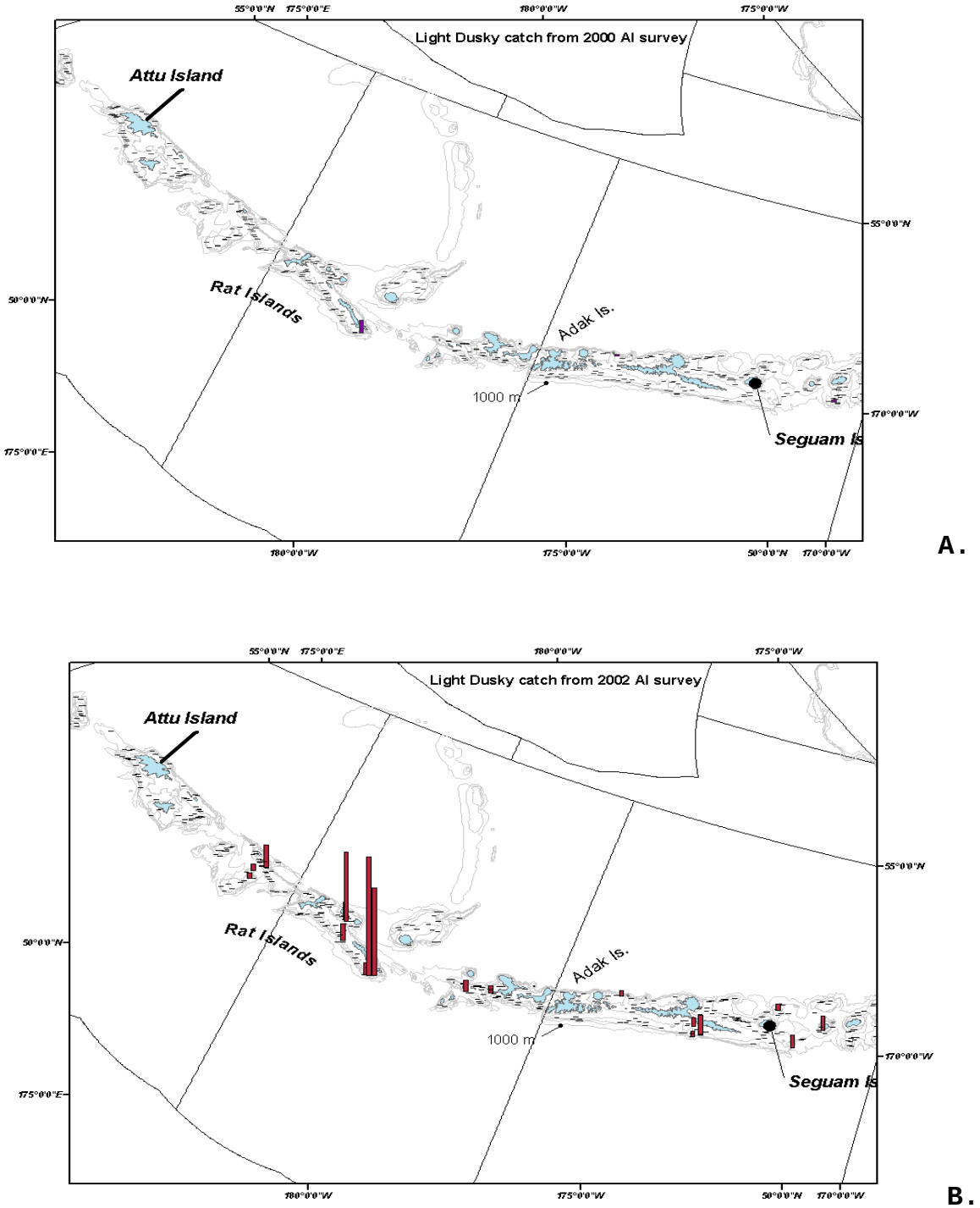
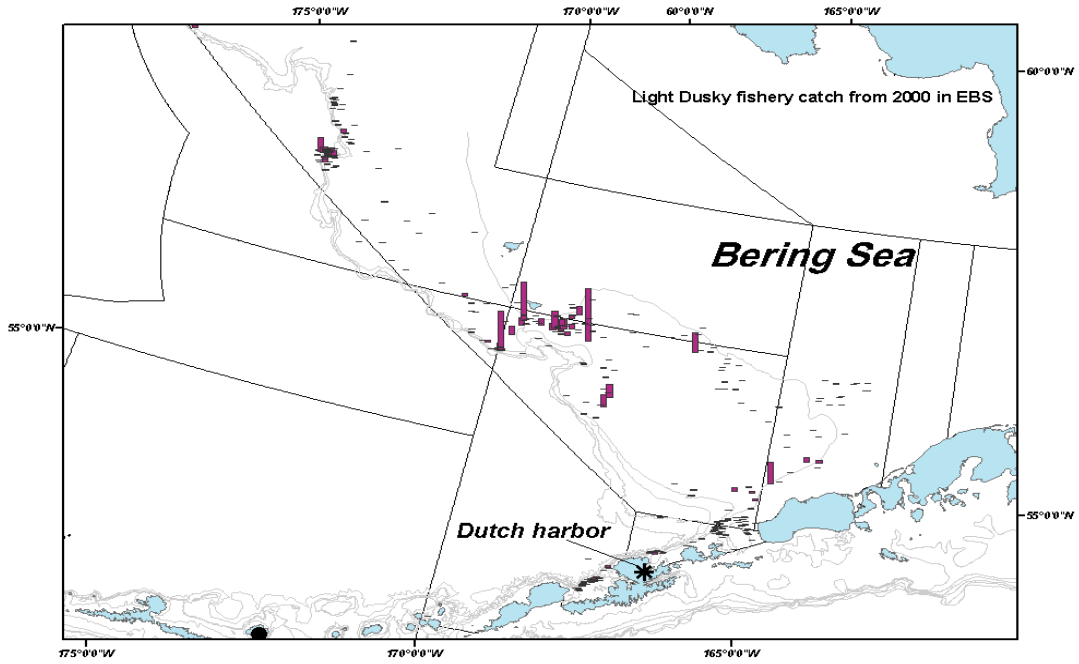


Figure 13.2. Light Dusky catch locations in the Aleutian Islands from survey data A. 2000 and B. 2002, (datasource: AFSC RACE database). *Note: Bars from different years are proportional.*



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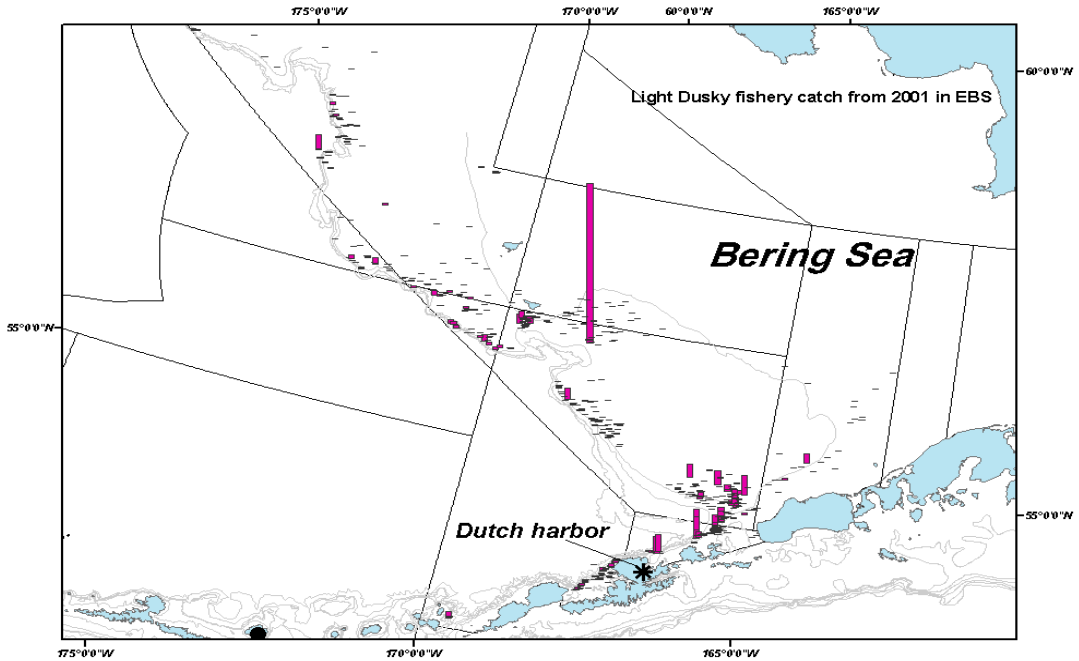
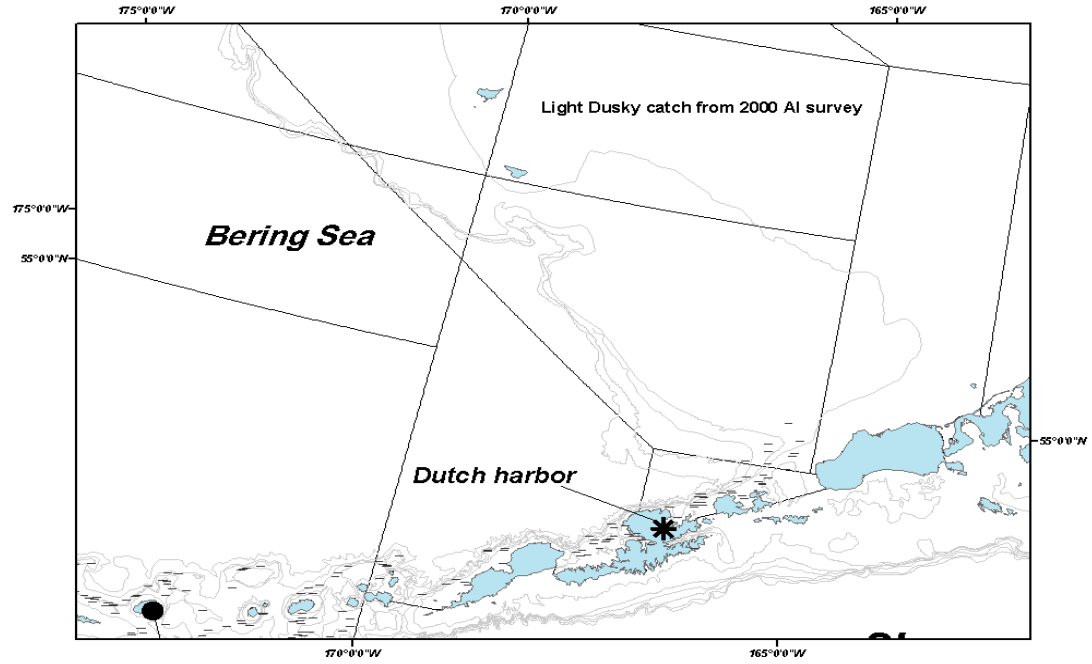


B.

Figure 13.3. Catch distribution in the EBS of Light dusky rockfish from fishery data A. 2000 and B. 2001. (Source: AFSC Norpac database) *Note: Bars from both years are proportional.*



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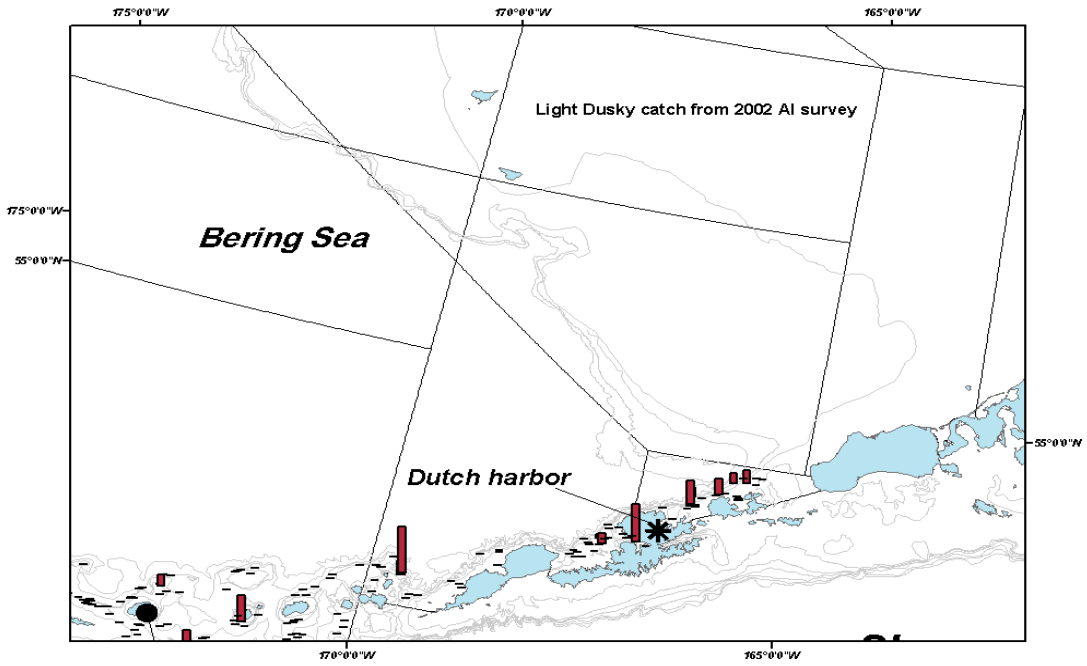
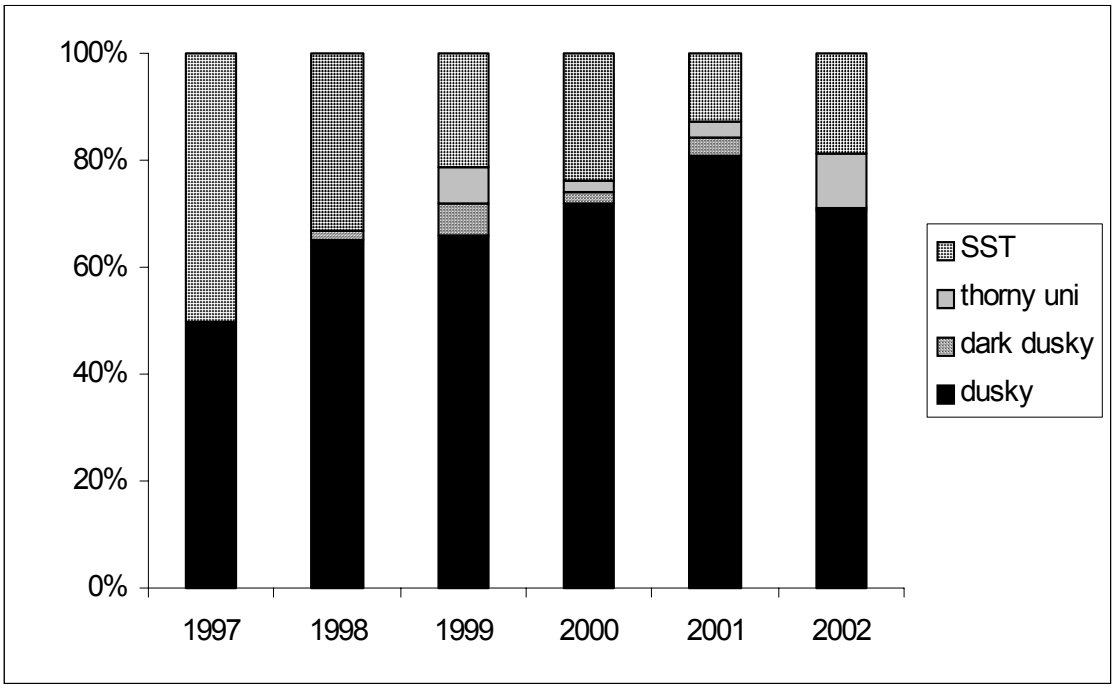
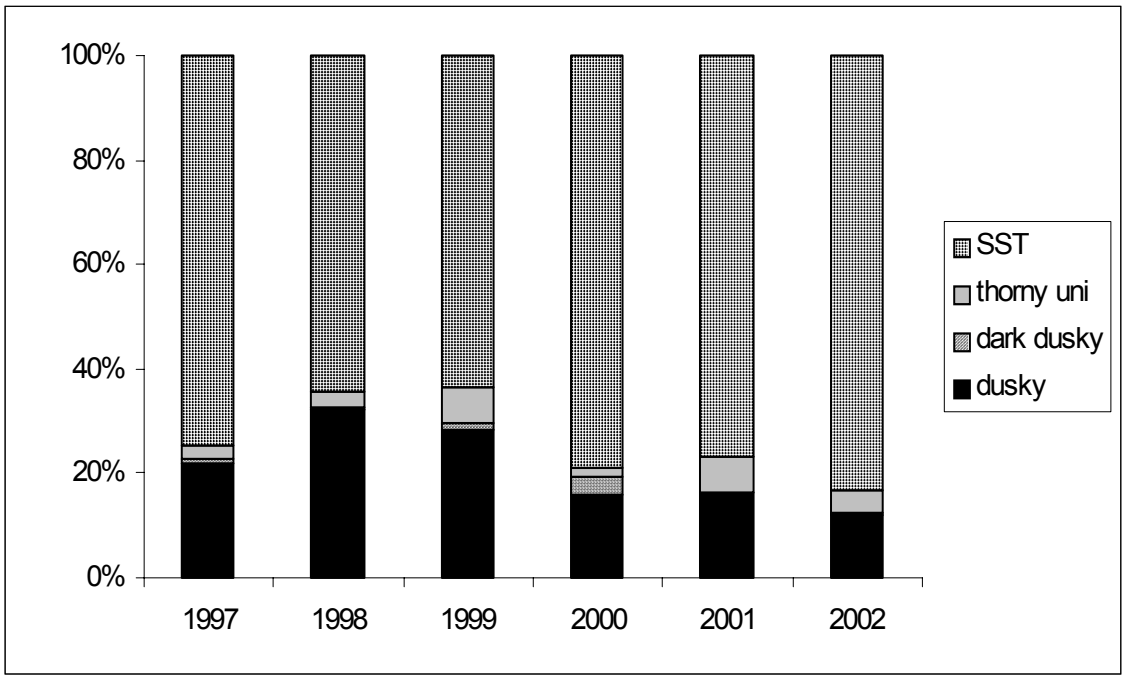


B.

Figure 13.4. Light Dusky catch locations in the Southern Bering Sea from the AI survey data, A. 2000 and B. 2002. *Source: AFSC RACE database*

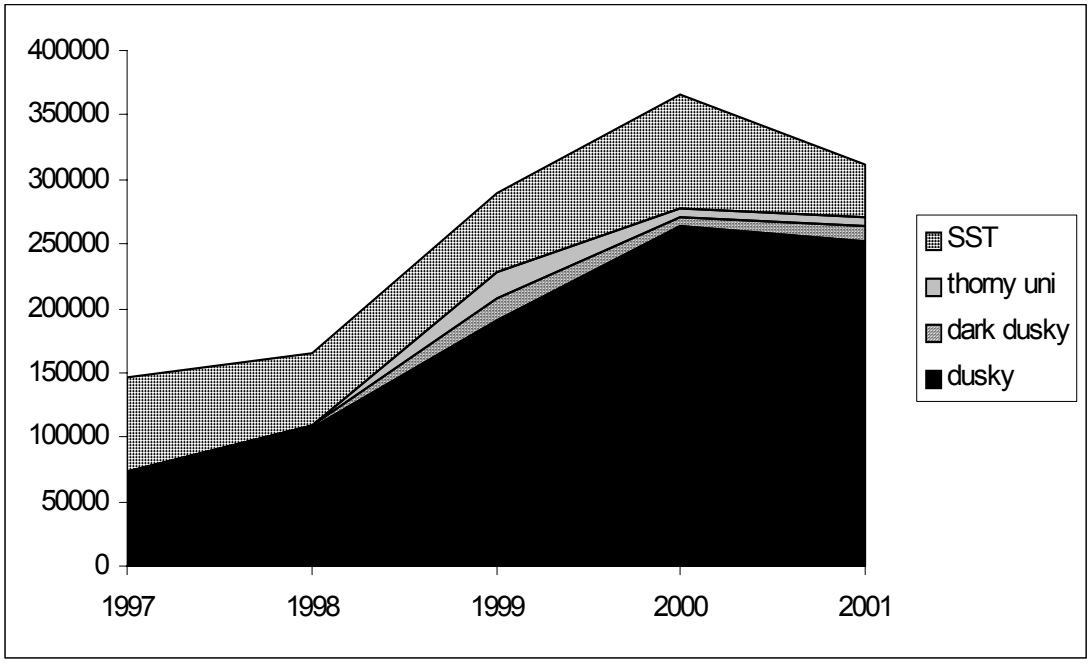


A.



B.

Figure 13.5. Proportion, from fishery data, of individual species catches to the total Other rockfish catch by year A. Aleutian Islands, B. Eastern Bering Sea.



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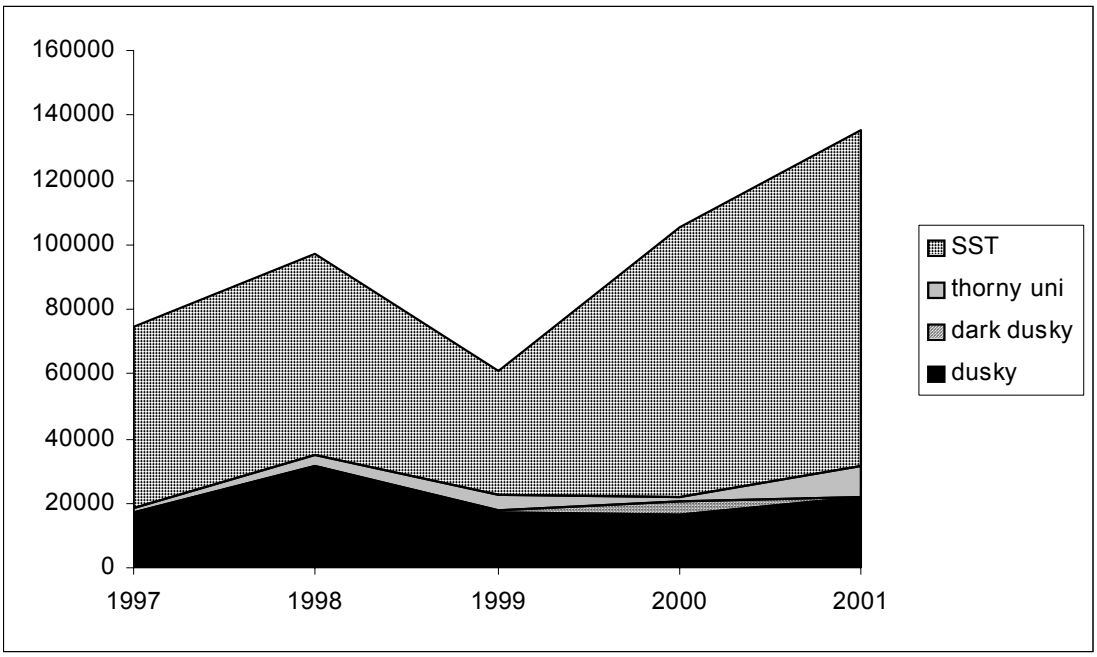


B.

Figure 13.6. Graphs of observed catch (t) for main Other rockfish species in, A. Aleutian Islands and B. Eastern Bering Sea. *Data source: NORPAC at AFSC Seattle WA.*

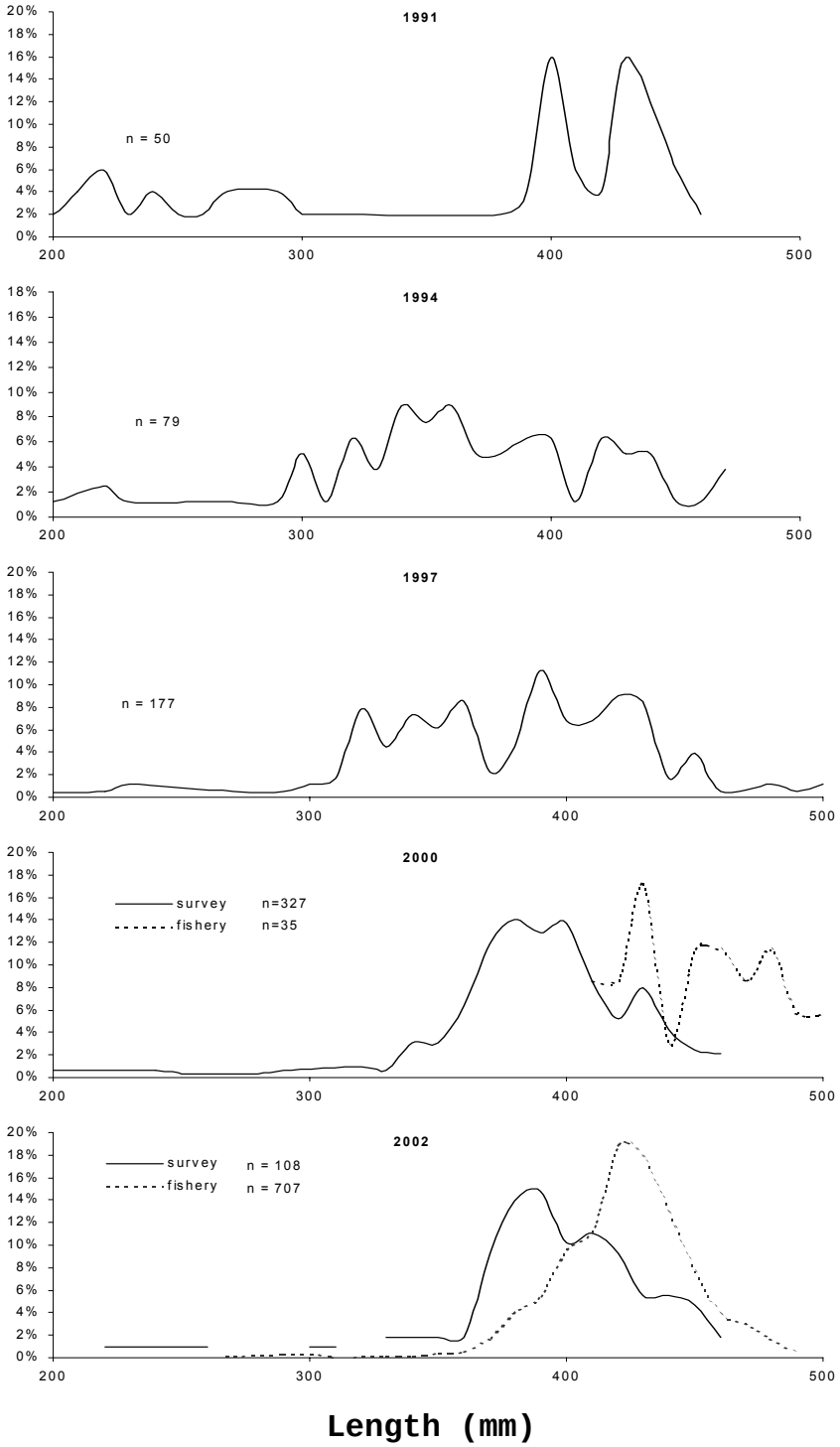


Figure 13.7. Length frequency for light dusky rockfish from the Aleutian Islands research surveys. Fishery data included when available. *Source: AFSC RACE survey data*.

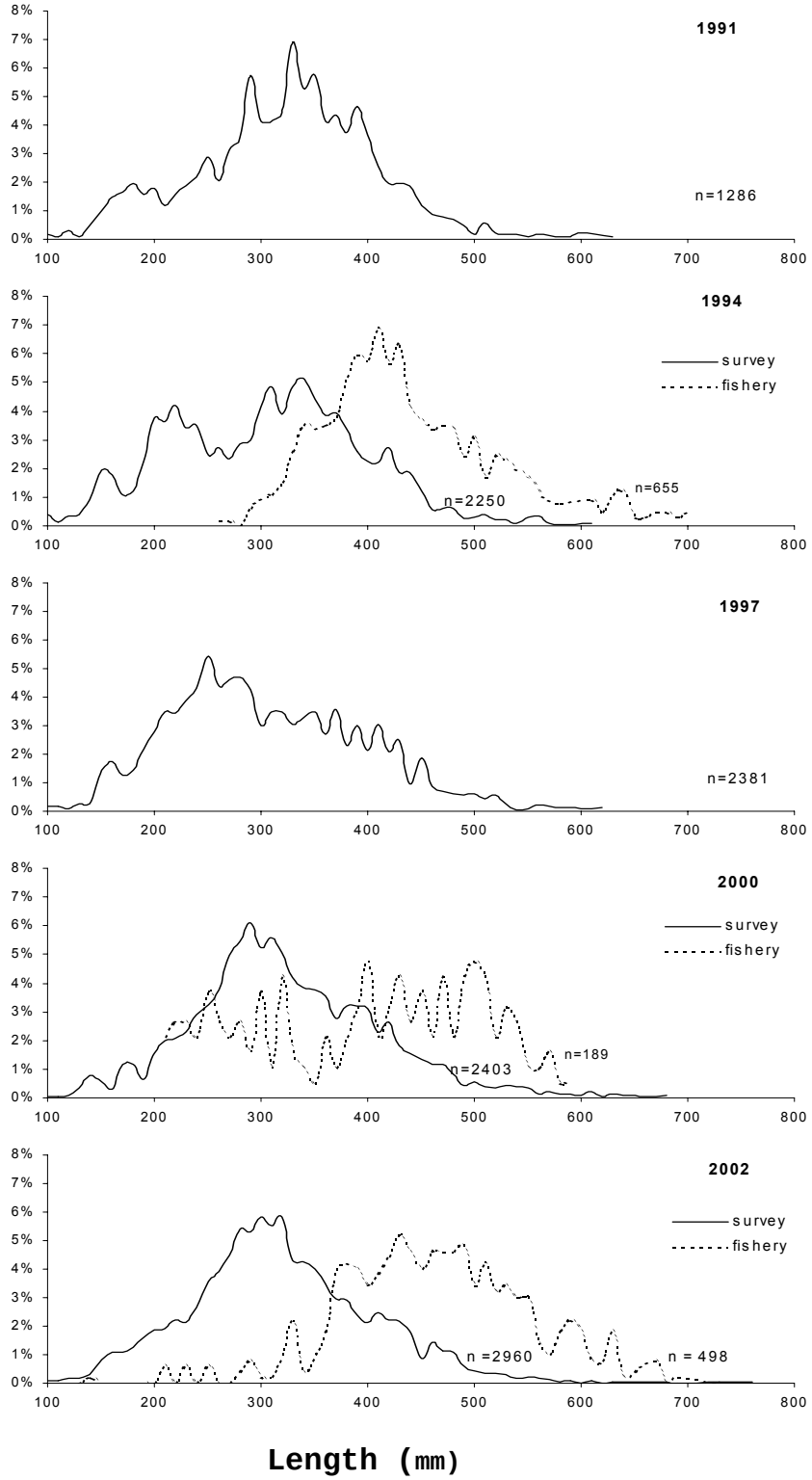


Figure 13.8. Length frequency for shortspine thornyhead from the Aleutian Islands research surveys. Fishery data included when available. *Source: AFSC RACE survey data.*

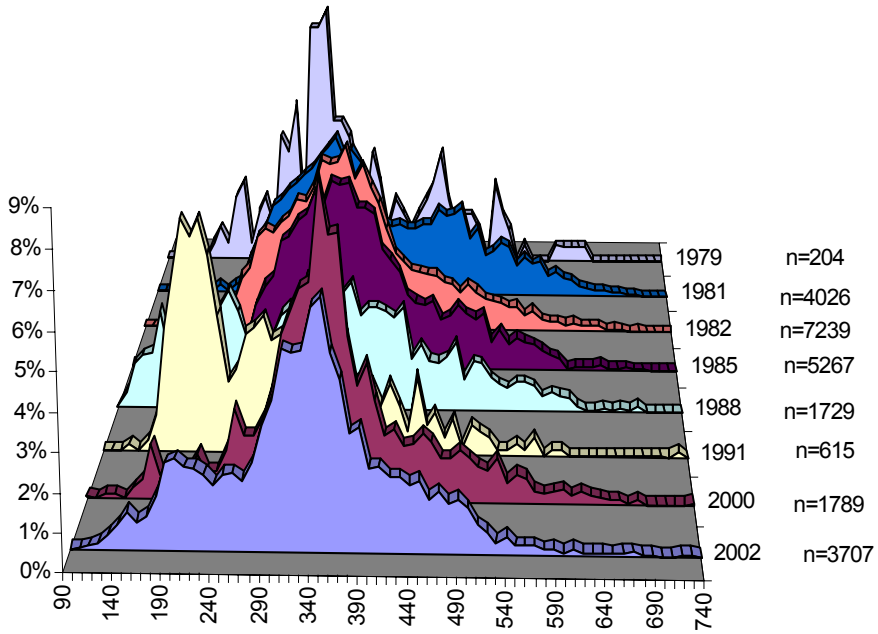
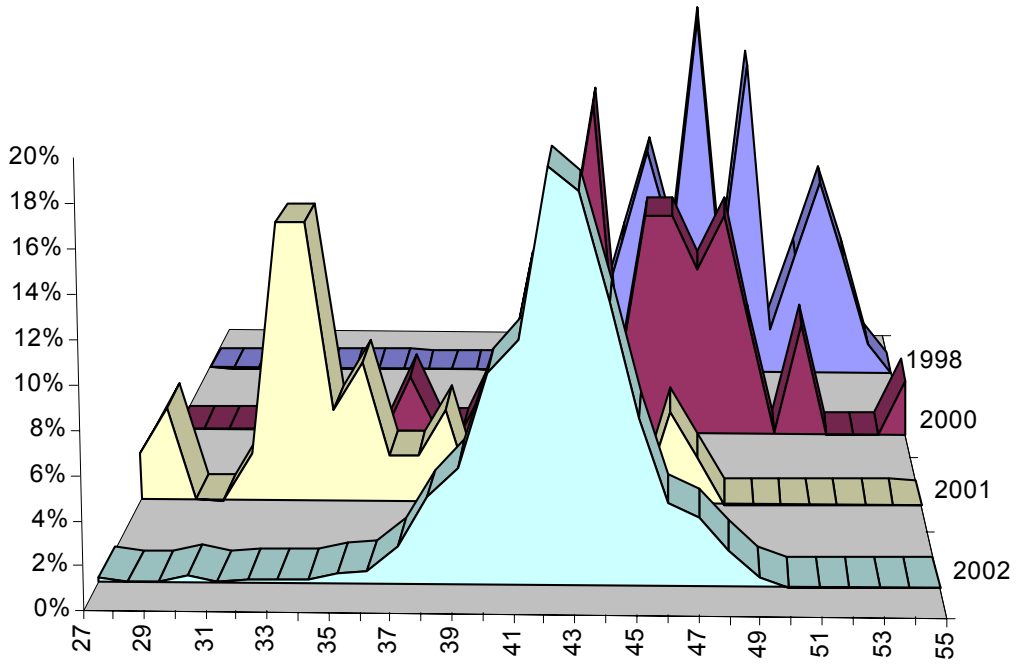
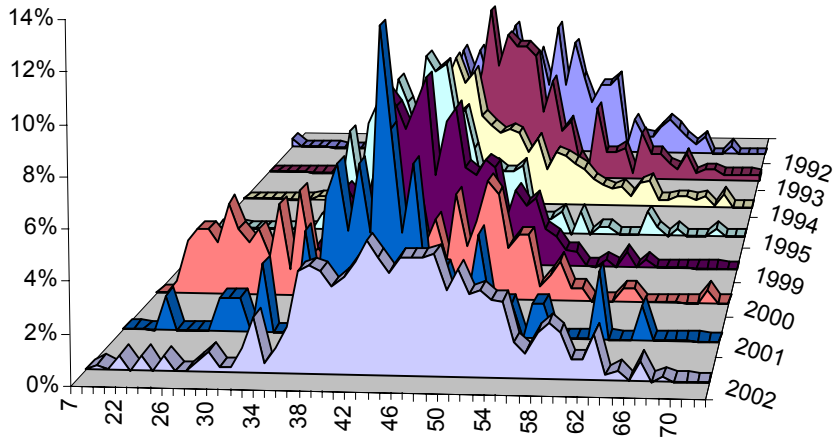


Figure 13.9. Length frequency for shortspine thornyhead from the Eastern Bering Sea research surveys.
Source: AFSC RACE survey data.



A.



B.

Length (cm)

Figure 13.10. Length frequency of A. Light dusky rockfish and B.Shortspine thornyhead from fishery data in the Aleutian Islands. *Source: NorPac Database AFSC Seattle WA.*